Journal of Applied Mechanics and Technical Physics 2014 vol.55 N5, pages 843-856

Relationships of the Timoshenko-type theory of thin shells with arbitrary displacements and strains

Paimushin V.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2014, Pleiades Publishing, Ltd. A new modified version of the Timoshenko theory of thin shells is proposed to describe the process of deformation of thin shells with arbitrary displacements and strains. The new version is based on introducing an unknown function in the form of a rotation vector whose components in the basis fitted to the deformed mid-surface of the shell are the components of the transverse shear vector and the extensibility in the transverse direction according to Chernykh. For the case with the shell mid-surface fitted to an arbitrary non-orthogonal system of curvilinear coordinates, relationships based on the use of true stresses and true strains in accordance with Novozhilov are obtained for internal forces and moments. Based on these relationships, a problem of static instability of an isotropic spherical shell experiencing internal pressure is solved. The shell is considered to be made either of a linear elastic material or of an elastomer (rubber), which is described by Chernykh's relationships.

http://dx.doi.org/10.1134/S0021894414050149

Keywords

elastomer, finite displacements, finite strains, internal pressure, nonlinear theory, spherical shell, static instability, thin shell, Timoshenko model, true strains, true stresses